

Project A.W.A.R.E. Sampling Results for June 2005 on the Upper Little Sioux River

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Abstract: From June 18-25th, 2005, more than 200 volunteers removed trash from the Little Sioux River and sampled 12 sites for various water quality parameters in Dickinson, O'Brien, Clay, Cherokee, and Buena Vista counties in Northwest Iowa as part of Project AWARE. A snapshot sampling is when multiple sites throughout a geographic area are sampled within a short period of time. While these events enable collection of baseline data and can highlight areas for follow-up monitoring, they also prove to be beneficial in getting volunteers in the IOWATER Program (Iowa's volunteer water monitoring program) involved in collecting water quality data on a watershed or county scale. This snapshot included chemical, physical, and habitat measurements. Monitoring of roughly 12 sites along the Little Sioux River during Project AWARE and 85 sites statewide by the Ambient Water Monitoring Program created a warm water stream dataset for comparing the relationships between the Little Sioux River and warm water streams across the state. Water temperature was similar to those sampled statewide. pH was slightly higher than other streams sampled statewide, where as dissolved oxygen levels were significantly lower. The significantly lower dissolved oxygen levels are of concern given some of the values are near the warmwater aquatic life standard of 5 mg/L. There was no water odor and water color was brown at all 12 sites on the Little Sioux River.

Introduction

From June 18, 2005 to June 25th, 2005, over 200 Project AWARE (A Watershed Awareness And River Expedition) volunteers removed trash from the Little Sioux River in NW Iowa. Project AWARE is a 7-day, 7-night canoe trip down an Iowa river where volunteers remove trash and take part in evening educational programs. The trip began at Twin Forks Access in Dickinson County and traveled southward over the next week to the final destination, Spring Lake Park in Cherokee, Cherokee County. Water quality measurements were made at starting, half-way, and take-out points for each day. All together this data set is represented by 12 sites throughout Dickinson, O'Brien, Clay, Cherokee, and Buena Vista counties (Figure 1). The data points for each day provide a picture of water quality at one point in time.

For all sites sampled on the Little Sioux River during Project AWARE volunteers collected data using IOWATER field methods. Data collected are intended to provide a picture of water quality in the Little Sioux River at various collection locations throughout the main stem.

This report summarizes the water quality from the 2005 Project AWARE sampling of 12 main stem Little Sioux River sites (Figure 1), and includes chemical and physical results (Table 1).

Table 1. Project AWARE Sampling Results – June 18 - 25, 2005.

	Unit	Method	# of samples	Min Value	Percentiles			Max Value
					25th	50th	75th	
Water Temperature	degrees F	Thermometer - Field	12	69	70.8	71	72.5	76
Nitrite-N	mg/L	IOWATER test strip	12	0	0	0	0	0
Nitrate-N	mg/L	IOWATER test strip	12	5	5	5	10	10
Dissolved Oxygen	mg/L	IOWATER Field strip	12	5	5	6	6.5	8
Chloride	mg/L	IOWATER test strip	12	31	31	31	31	38
Transparency	centimeters	IOWATER transparency tube	12	7	10.4	13.5	15	25

mg/L = milligrams per liter (or parts per million - ppm)



Sampling locations AWARE 2005

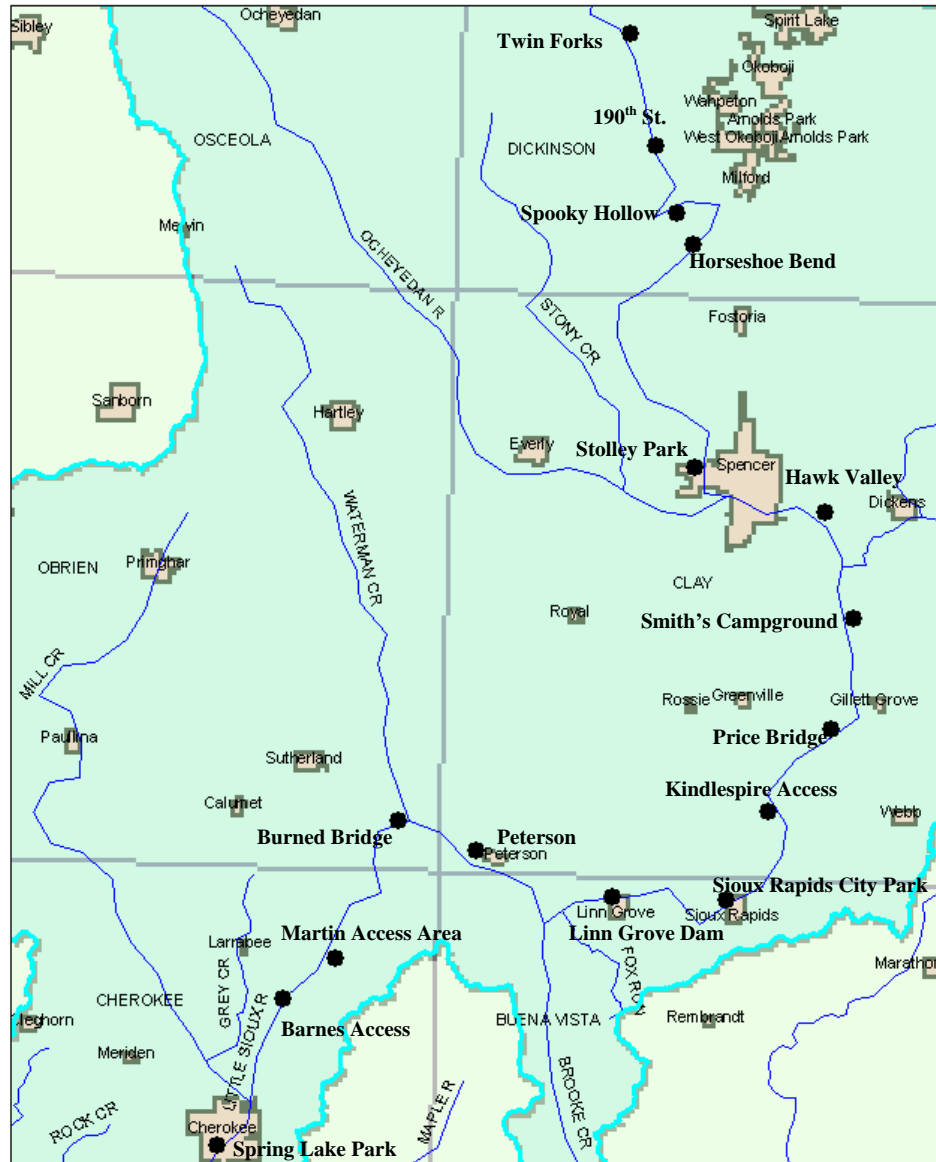


Figure 1. Location of sites sampled as part of the 2005 Project AWARE Little Sioux River sampling.

Chemical and Physical Parameters

Water Temperature

Water temperature affects many of the biological, chemical, and physical processes in a stream, including the amount of oxygen gas that can dissolve in water, the rate of photosynthesis by algae and plants, as well as the metabolic rate of aquatic animals.

Water temperature was measured at 12 sites during June 18-25, 2005 for the 3rd Annual Project AWARE. Water temperatures varied from 69 to 76 degrees Fahrenheit, with the lowest temperature reported at Twin Forks and the highest at Riverside Access near Peterson, IA respectively (Figure 1). Little Sioux River sites averaged 71.8 degrees Fahrenheit (Table 1, Figure 2).

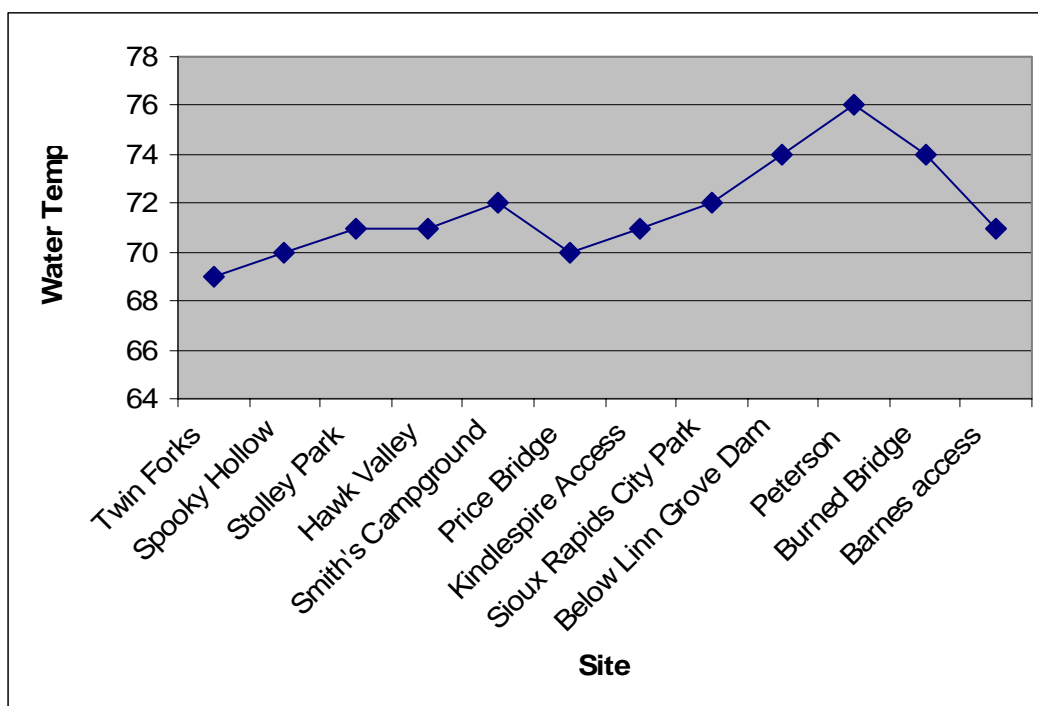


Figure 2. Graph of water temperature data from sites sampled as part of the Little Sioux River Project AWARE event.

Water temperature for Little Sioux River sites sampled were similar compared to those collected from streams statewide during the same time periods (Figure 3). A network of 85 streams statewide is monitored monthly as part of Iowa's Ambient Water Monitoring Program. Samples from these streams are tested using field meters and lab analyses, and data from these sites will be used throughout this report to provide perspective on results from the 2005 Little Sioux River Project AWARE.

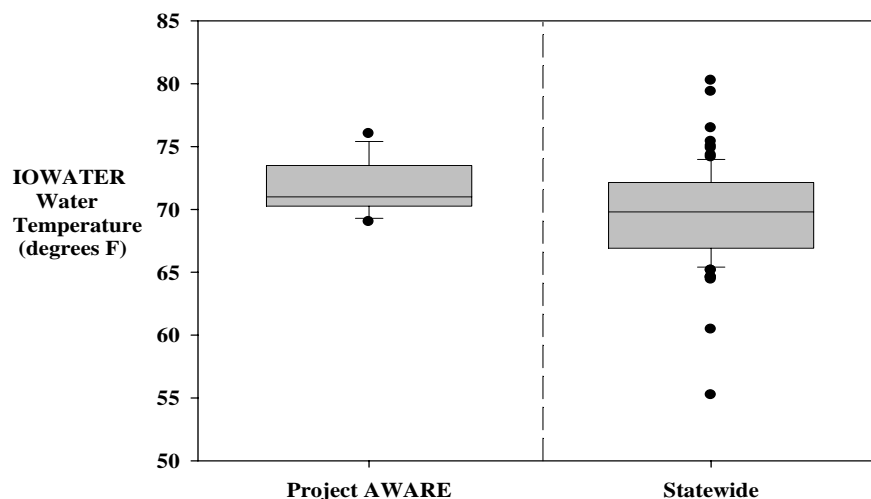


Figure 3. Box plot of water temperature values collected from Project AWARE and Ambient Water Monitoring Program.

pH

pH is a measure of water's acid/base content. Changes in pH can be caused by atmospheric deposition of acid rain, the types of soils and bedrock that the water comes in contact with, wastewater discharges, and acid mine drainage. A pH of 7 is neutral; pH values greater than 7 are alkaline or basic, while a pH less than 7 is acidic.

pH was measured at 12 sites during June 18-25, 2005. During the sampling, the majority of sites had a pH of 9, with the exception of Stolley Park and Barnes Access, which had pH value of 8 (Table 1, Figure 4). The pH values collected on AWARE are similar to what was measured during June of 2005 in streams statewide as part of Iowa's Ambient Water Monitoring Program (Figure 5).

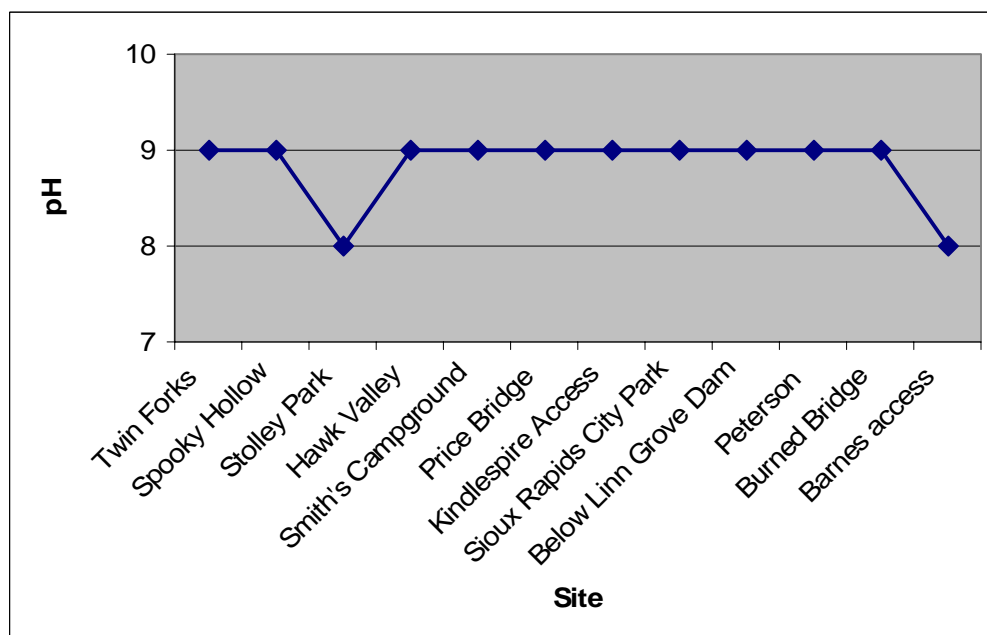


Figure 4. Graph of pH data from sites sampled as part of the Little Sioux River Project AWARE.

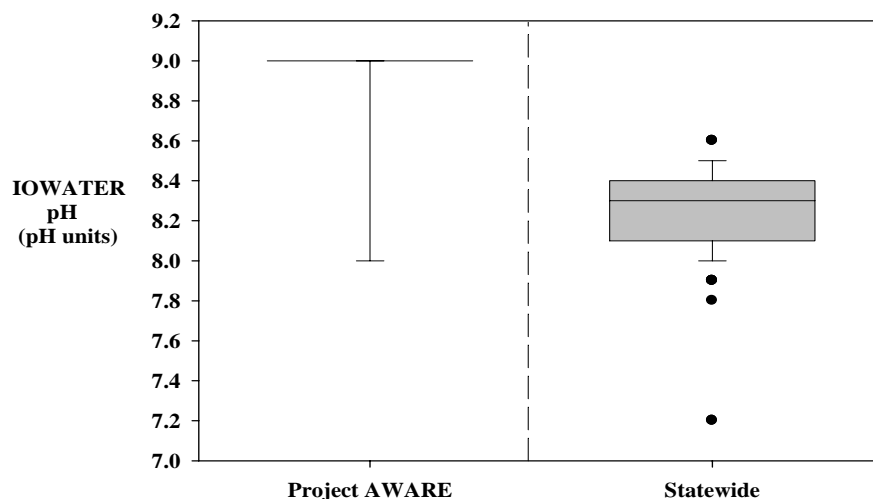


Figure 5. Box plot of pH values collected from Project AWARE and Ambient Water Monitoring Program.

Transparency

Transparency is a measure of water clarity and is affected by the amount of material suspended in water. As more material is suspended in water, less light can pass through the water, making it less transparent (or more turbid). These materials include soil, algae, plankton, and microbes.

Transparency was measured at 12 sites from June 18-25, 2005. Transparency ranged from 7 to 25 centimeters with a median of 13.5 centimeters (Table 1; Figure 6). The lowest transparency reading was measured at Barnes Access near Cherokee, IA where monitors observed a brown water color. The generally lower transparencies during the Project AWARE event on the Little Sioux River are likely associated with recent heavy rains and the influx in erosion from overland flow and stream bank erosion.

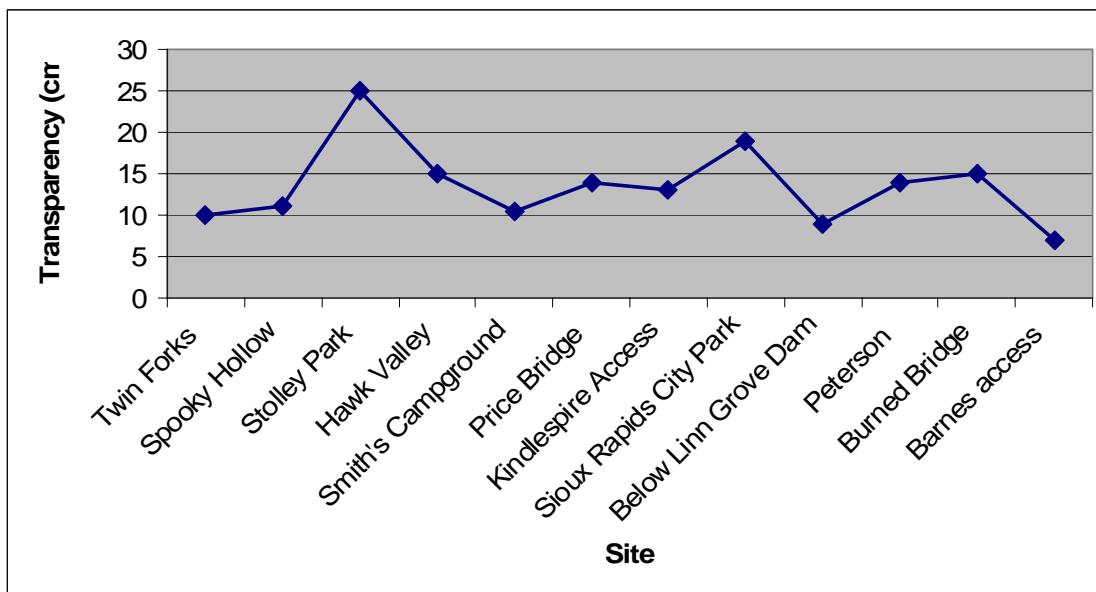


Figure 6. Graph of pH data from sites sampled as part of the Little Sioux River Project AWARE.

Dissolved Oxygen

Dissolved oxygen levels in a stream can be affected by a number of variables, including water temperature, season of the year, time of day, stream flow, presence of aquatic plants, dissolved or suspended solids, and human impacts. Oxygen enters a stream through diffusion from the surrounding air and as a product of photosynthesis from aquatic plants. Oxygen in a stream can be consumed through respiration by aquatic plants and animals, and by the decomposition of organic matter.

A total of 12 sites were sampled for dissolved oxygen during Project AWARE. The Little Sioux River had a median of 6.2 mg/L (Table 1; Figure 7). Stolley Park, Hawk Valley, Price Bridge, and Burned Bridge had a low value of 5 mg/L, while Twin Forks, Kindlespire Access, and Peterson had the highest values at 8 mg/L. All sites met the warm water dissolved oxygen standard of 5 mg/L. Little Sioux River dissolved oxygen levels were lower than those collected statewide during June (Figure 8).

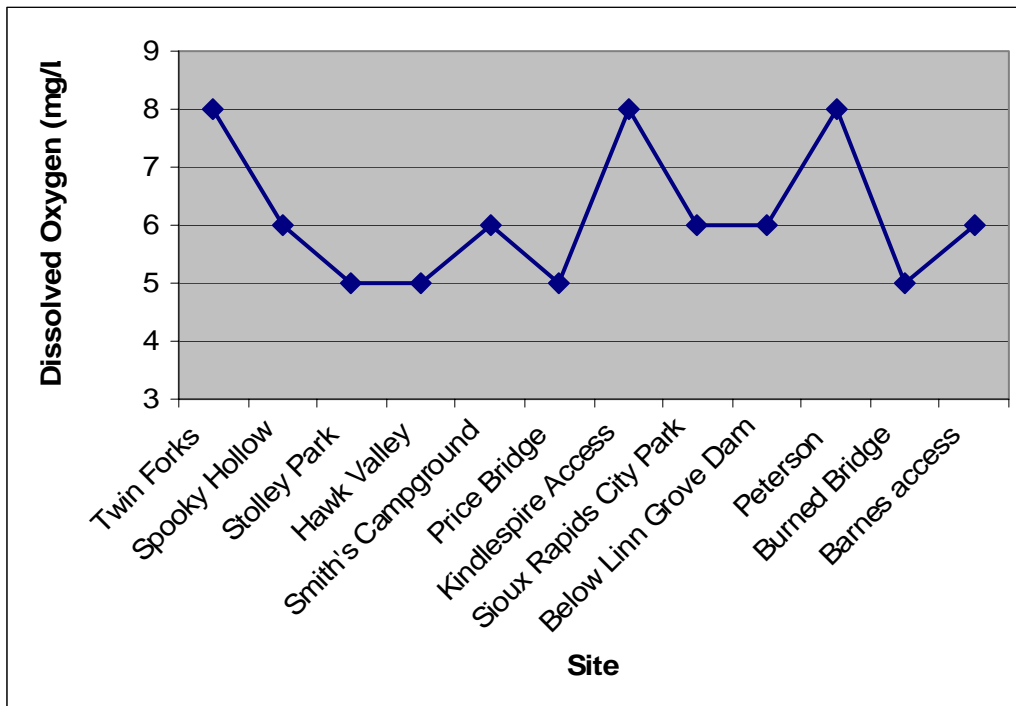


Figure 7. Graph of dissolved oxygen data from sites sampled as part of Project AWARE.

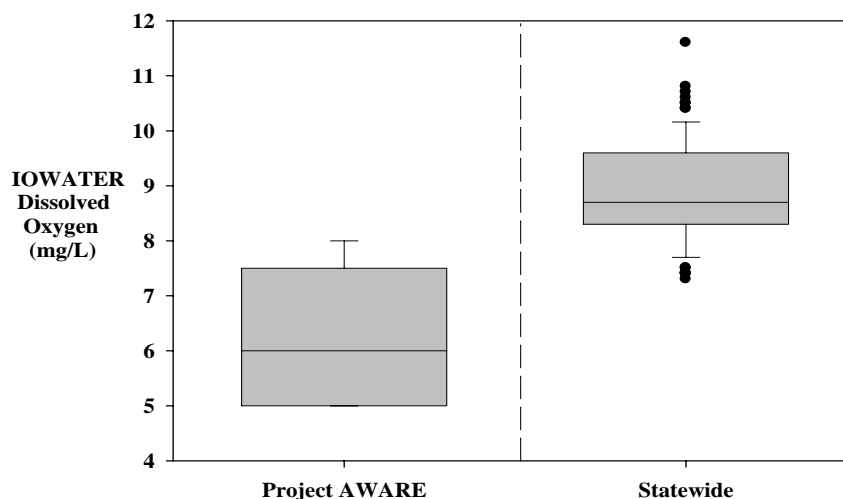


Figure 8. Box plot of dissolved oxygen values collected from Project AWARE and Ambient Water Monitoring Program.

Nitrite-N and Nitrate-N

Nitrogen is a necessary nutrient for plant growth, and includes both nitrite- and nitrate-nitrogen. Too much nitrogen in surface waters, however, can cause nutrient enrichment, increasing aquatic plant growth and changing the types of plants and animals that live in a stream. Sources of nitrogen include soils; human and animal wastes; decomposing plants; and fertilizer runoff from golf course, lawns, and cropland.

A total of 12 sites were tested for nitrate-N and nitrite-N using IOWATER test strips. The nitrite-N value using test strips was zero mg/L for all 12 sites (Figure 9). Nitrate-N values using test strips averaged 5 mg/L. Four of the 12 sites monitored for nitrate-N had values of 10 mg/L (Figure 9). The peak in nitrate-N during Project AWARE may be attributed to recent heavy rainfall in the watershed.

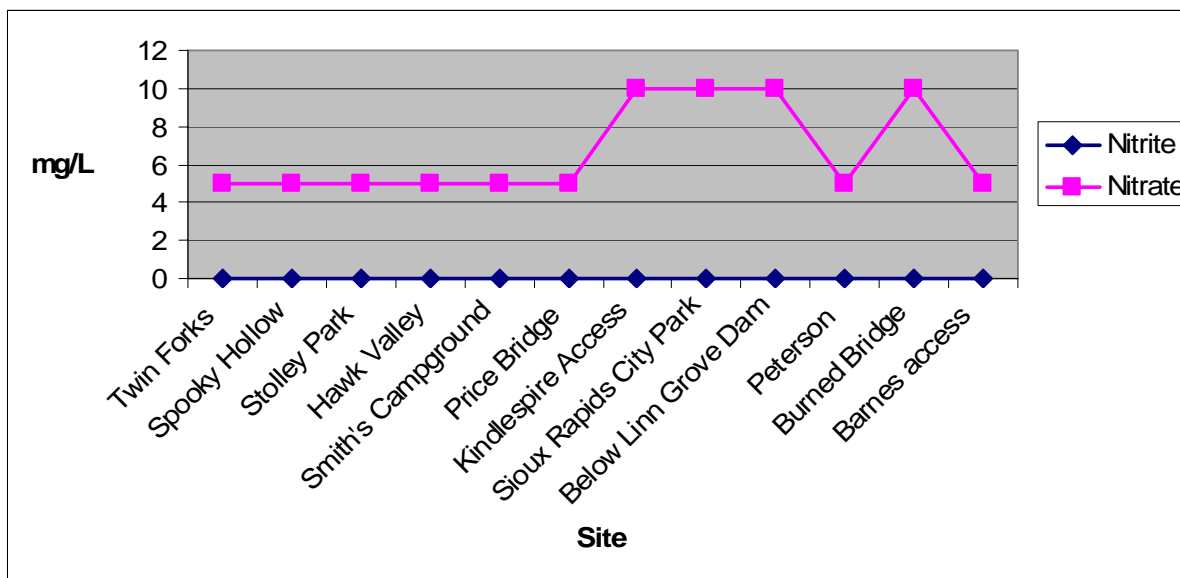


Figure 9. Graph of Nitrite and Nitrate data from Little Sioux River Project AWARE sites.

Phosphorus

Phosphorus is a necessary nutrient for plant growth. Too much phosphorus in surface waters, however, can cause nutrient enrichment, increasing aquatic plant growth, and changing the types of plants and animals that live in a stream. Sources of phosphorus include certain soils and bedrock; human and animal wastes; detergents; decomposing plants; and runoff from fertilized lawns and cropland.

A total of 12 sites were sampled for orthophosphorus during Project AWARE. Concentrations ranged from 0.2 to 1.0 mg/L, with a median of 0.75 mg/L (Figure 10).

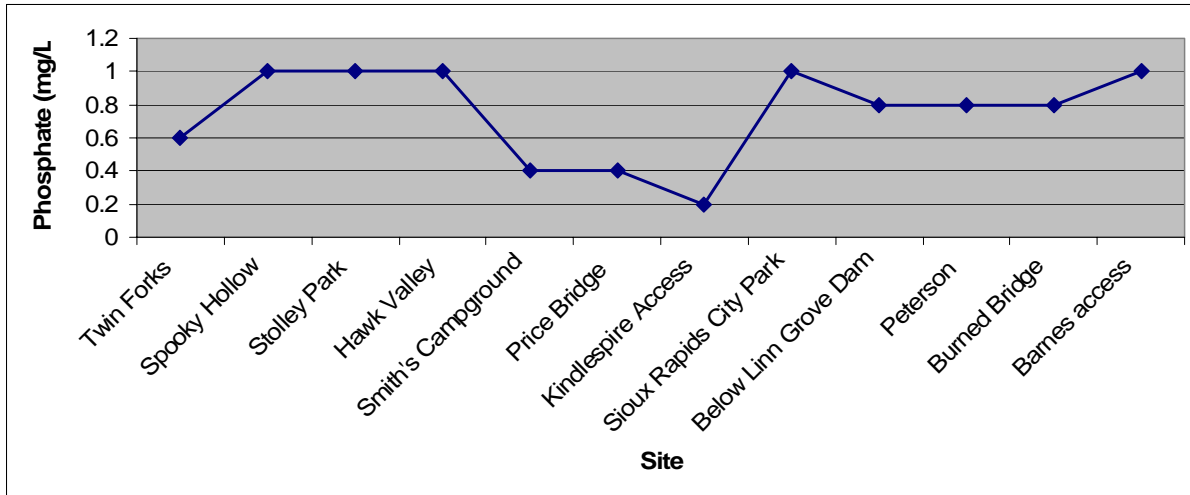


Figure 10. Graph of Phosphate data from the Little Sioux River Project AWARE sites.

Chloride

Chloride is a component of salt, and is a measure of human or animal waste inputs to a stream. Potential sources of chloride to a stream include direct input from livestock, septic system inputs, and/or discharge from municipal wastewater facilities. During winter months, elevated chloride levels in streams may occur as a result of road salt runoff to nearby streams.

Chloride concentrations in Iowa streams are typically in the 20 to 40 mg/L range. During Project AWARE 12 sites were monitored for chloride using IOWATER test strips. The majority of sites had a chloride concentration less than 31 mg/L (Figure 11). However, Stolley Park in Spencer, IA had a chloride reading of 38 mg/L. The higher reading at Stolley Park may be due to waste water discharge from the City of Spencer's Wastewater Treatment Facility. Lower values may be due to higher flows (e.g., more dilution).

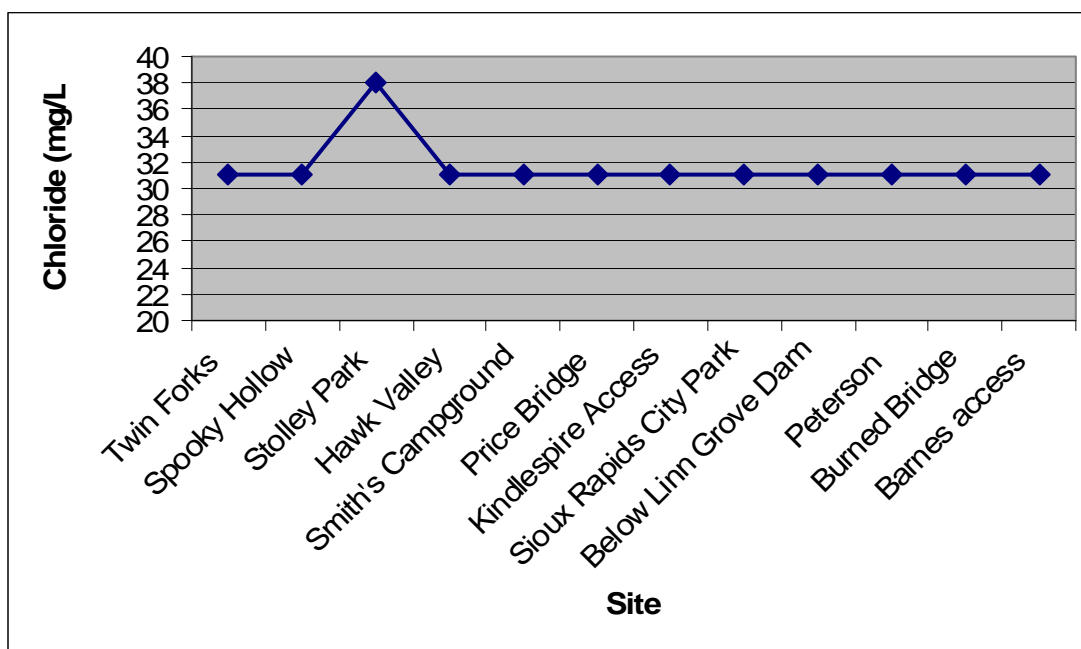


Figure 13. Graph of Chloride data from the Little Sioux River Project AWARE sites.

Water Odor & Water Color

Water odor and water color was recorded at 12 sites over the week long event. All sites reported no odor to the water and brown water dominated the water color observations, as shown by a median transparency value of 13.5 cm. Low transparency and brown color can likely be attributed to recent local heavy rain in the upper Little Sioux River watershed.

Summary

Of the ten parameters sampled during Project AWARE 2005 on the Little Sioux River, only pH and dissolved oxygen had different results to Iowa's Ambient Water Monitoring Program. Water temperature was similar to those sampled statewide. pH was slightly higher than other streams sampled statewide, where as dissolved oxygen levels were significantly lower. The significantly lower dissolved oxygen levels are of concern given some of the values are near the warmwater aquatic life standard of 5 mg/L. There was no water odor and water color was brown at all 12 sites on the Little Sioux River. We recommend sampling prior to each Project AWARE event to establish baseline data, during the trip, and following the trip. We also recommend using a tow-behind type data logger to continuously collect data on the stretch of river as the event is being held. This will allow for the establishment of baseline data for which comparisons can be made and trends observed.

Acknowledgements

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